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The role of selective mortality in the dynamics of SES-related health inequality across the lifecycle

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Abstract

The life course literature on the social gradient in health has been dominated by the cumulative advantage and age-as-leveller hypotheses, with selective mortality also recognised as a potentially important confounder in older cohorts. The main contribution of this paper is to establish a unified framework to fully account for the changing social gradient in terms of a sufficient set of mobility indices characterising the co-evolution of the joint distribution of socioeconomic status and health within any particular cohort. The main innovation is to identify selective mortality effects using a counterfactual health distribution for the start of the study period in the absence of those who are known to die before the end, rather than for the end of the period if there had been no deaths since the start which requires the imputation of the 'would be' health of non-survivors. Using longitudinal data for Great Britain, selective mortality is found to be an important driver of social gradient changes within older cohorts, contrary to the findings of a number of previous studies. We explain this contrast by demonstrating how estimates of selective mortality effects are affected by the choice of counterfactual health distribution and socioeconomic status measure.

Keywords: life course, social gradient, mobility analysis, selective mortality, longitudinal data

JEL classifications: D39, D63, I18

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1. Introduction

The life course literature on the social gradient in health has been dominated by the cumulative (dis)advantage and age-as-leveller hypotheses (Siegel and Allanson, 2016). The former posits that social gradients develop in early life and become stronger as socioeconomic and health disadvantages accumulate across the life course, while the latter maintains that health inequalities narrow in older age groups as changes in health become more closely associated with age than socioeconomic status (SES). In combination, these two mechanisms may serve to explain the stylised fact that health inequalities in adulthood widen through middle and early old age and then diminish in later old age (Deaton and Paxson, 1998, Smith, 2007; Siegel and Mosler, 2014), with selective mortality also recognised as a potentially important confounder in older cohorts if only the more robust in lower SES groups survive (Dupre, 2007). van Kippersluis et al. (2010, p.436) conclude that there is unlikely to be a "single explanation for the observed lifecycle pattern of the social gradient" but rather "many mechanisms interacting".

However if this is taken to be the case then a notable weakness of the literature is the lack of any unified framework to identify all the channels through which these mechanisms may influence the co-evolution of SES and health over the lifecycle and quantify their contribution to changes in (SES-related) health inequality. We would argue that this shortcoming has largely resulted in a series of piecemeal assessments of the relative importance of specific mechanisms, often implicit in nature. In particular, neither Beckett (2000) nor Herd (2006) nor Baeten et al. (2013) explicitly evaluate the impact of selective mortality on health inequality, relying on indirect evidence instead to suggest that it can only play a minor role. The main objective of this paper is to fill this gap by fully accounting for the changing social gradient at different ages in terms of a sufficient set of mobility indices characterising the co-evolution of the joint distribution of SES and health.

For this purpose, we propose a procedure to identify the impact of individual SES changes, morbidity changes and deaths on health inequality within each of a series of overlapping cohorts, building on the set of decomposition methods developed in Allanson and Petrie (2013a) to analyse such changes at the population level using longitudinal data. A particular attraction of our approach is the clear demonstration of how the changing association between SES and health on the one hand and death on the other affects the impact of selective mortality on the evolution of health inequality over the life cycle. The decomposition procedure further allows for the potentially bidirectional relationship between SES and health, conditional upon survival, facilitating the interpretation of the results from a Granger causality perspective.

To help fix ideas about the possible impact of selective mortality consider a simple example based on a population of whom half are high SES and relatively healthy and the other half low SES and relatively unhealthy. We consider two scenarios of possible changes over some time interval. In scenario 1, all the high SES individuals retain their SES status but half of them experience a positive health change and the other half an equal but negative health change. Similarly, the low SES individuals keep their SES status but half experience a positive health change and the other half an equal but negative health change. Health inequality will be the same at the end of the interval since the average health change is zero for both high and low SES individuals. In scenario 2, the only difference is that the low SES individuals who experience the negative health shock are now assumed to die as a result. The observed health inequality in the extant population will clearly be lower at the end of the interval due to the 'direct' effect of the loss of half the unhealthy low-SES individuals from the initial population. Moreover, as an 'indirect' effect of these deaths, health changes among the surviving population will now appear to be progressive or 'pro-poor' since the average health change of the low SES individuals conditional on survival will be positive. We consider below how these 'direct' and 'indirect' effects of selective mortality relate to established explanations of changes in cross-sectional health inequality within older cohorts.

The most straightforward interpretation of the selective mortality hypothesis rests on the proposition that the people who die over some time interval will have been on average both of lower SES and less healthy at the start of the interval than those who survive, all else equal, where this is the case in Scenario 2 of our illustrative example and is more generally held to be true (see, e.g., Herd, 2006). However this between-group effect – between non-survivors and survivors – is not the only one that must be taken into account when considering the direct impact of selective mortality on inequality. In particular, the change in cross-sectional health inequality will also be affected by any difference between the levels of health inequality within the non-survivor and survivor groups at the start of the interval, where in Scenario 2 this within-group difference effect will have partially offset the fall in health inequality due to the between-group effect because the non-survivors were all equally low-SES and unhealthy at the start of the interval unlike the heterogeneous survivor group. Moreover, rank-dependent health inequality measures will be sensitive to the difference between the relative positions of survivors at the start of the interval in the distributions of SES defined over the full and survivor populations. It follows that the direct effect may not be negative even if non-survivors are on average of lower SES and less healthy than survivors.

According to the age-as-leveller hypothesis, the attenuation of health inequality in older cohorts occurs because socioeconomic advantages can only delay not prevent morbidity (House et al., 2005), with age increasingly dominant as a determinant of health in later life (Lynch, 2003). In Scenario 2 of our example, we observe a convergence in health trajectories between the rich and poor conditional upon survival, but as previously noted this is only because of the indirect effect of selective mortality. Mirowsky & Ross (2008) report findings consistent with the existence of such convergence due to selective mortality, dismissing its importance "when combining the full range of adult ages" (p.112) but noting "the possibility of significant compression or selection effects in [..] much older samples" (p.114). Importantly, the existence of such indirect selection effects will be a source of bias in methods, such as those used by Beckett (2000) and Baeten et al. (2013), that seek to estimate the direct effect of selective mortality on health inequality by imputing the 'would be' health (cf. Lynch, 2003) of non-survivors at the end of the interval based on the observed health outcomes of survivors who had similar characteristics to them at the start of the interval. In Scenario 2, this approach would imply assigning non-survivors the end of interval health of low-SES survivors, but this counterfactual prediction is higher even than the average final health of the low-SES group in Scenario 1. More generally, it seems likely to generate upwardly biased estimates of health under most reasonable assumptions (Noymer, 2001). For example, we present results in this paper that imply that average health changes among survivors of similar age, SES and health as non-survivors at the start of the study period are consistently more positive/less negative than among all survivors. Thus imputation methods based on the observed outcomes of survivors are likely to underestimate the size of the direct effect of selective mortality, where it may be noted that this argument does not rest on the proposition that the actual health outcome of non-survivors, i.e. death, is manifestly worse than any health state experienced by those whom survive (cf. Petrie et al., 2011).

The next section of the paper sets out our decomposition methodology which serves to identify both the direct effects of selective mortality and the contributions of health and SES changes to health inequality changes among survivors. Our approach has the advantage of not requiring the imputation of the 'would be' health of non-survivors, although this is necessary to put bounds on the likely size of the indirect effect of selective mortality. Section 3 introduces the empirical study with the results presented in the following section. We use longitudinal data for Great Britain (GB) to explore the dynamics of SES and health and, more specifically, to demonstrate that selective mortality is an important driver of changes in cross-sectional health inequality over the lifecycle, contrary to the findings of many previous studies. Section 5 concludes.

2. Accounting for changes in health inequality by age group using longitudinal data

This section proposes a procedure to decompose the change in health inequality within an age cohort over some time interval marked by a start and an end date. The first stage of the decomposition serves to separate out the direct effect of selective mortality from the net effect of morbidity and SES changes, where the order in which these two effects are taken into account in the decomposition may be expected to affect the results given the familiar path dependency problem (see e.g. Lerman and Yitzhaki, 1985).[1] The typical approach to this problem has been to consider what the joint distribution of SES and health might have been at the end date if there had been no deaths during the time interval (e.g. Beckett, 2000; Baeten et al., 2013). However the construction of this end date counterfactual requires the imputation of the health (and SES) of non-survivors which, as argued above, will typically lead to underestimates of the direct effect of selective mortality if based on the health outcomes of survivors. The equally valid alternative is to consider what the joint distribution might have been at the start date in the absence of those who are known to die during the time interval. This approach is straightforward to implement if the counterfactual is simply taken to be the joint distribution of the survivor group at the start date on the assumption that this is

[1] In principle this indeterminacy can be resolved through the use of a 'Shapley value' average of the two possible decomposition pathways (see Shorrocks, 2013), but the resultant measures lack ready interpretation while still requiring imputation of the health of non-survivors.

independent of the existence of the non-survivor group. We focus on this alternative approach but present decompositions based on both start and end date counterfactuals so as to permit an empirical assessment of the implications of the choice.

We illustrate our proposed decomposition procedures using the Erreygers index (Erreygers, 2009) to measure health inequality and with health standardised (in the sense of Erreygers & van Ourti, 2011) to lie between 0 and 1. The Erreygers index assumes an equal absolute loss (or gain) of health for everyone will leave inequality unchanged and is equal to 1 when the richest 50% of the population are in the best possible health and the poorest 50% of the population in the worst possible health. Similar methods could also be used to examine health inequality changes from a relative perspective in either attainments or shortfalls (see Allanson and Petrie (2013b) and Kjellsson et al. (2015)), but the resultant decompositions would be more unwieldy as changes in relative health inequality will depend on changes in both the absolute dispersion and mean level of health.

2.1 Decomposition procedure based on start date counterfactual

We consider the change in cross-sectional health inequality between some start date *s* and an end date *f* in an age cohort *c* (*c*=1,…*C*) that is only subject to change due to deaths.[2] The initial population of the cohort is $\Omega_{cs} = \Omega_{CO}$ of whom a sub-group of non-survivors Ω_{NS} die during the time interval to leave the population of survivors $\Omega_{cf} = \Omega_{SU}$ at the end date. Let $EI_{ct} = 8\text{cov}(\Omega_{ct}, h_t, F_{\Omega_{ct}}(y_t))$ denote the Erreygers index of the cohort at date *t* (*t*=*s, f*), which is given for the population of interest Ω_{ct} as eight times the covariance between health h_t and the cumulative distribution function or fractional rank of SES $F_{\Omega_{ct}}(y_t)) = P(y_{ct} < y)$ within Ω_{ct}. Finally let $EI_{cs}^{g} = 8\text{cov}(\Omega_g, h_s, F_{CO}(y_s))$ be the within-group Erreygers index

[2] Consideration of sources of sample attrition other than mortality is addressed in the empirical section.

of group g (g=SU, NS) at the start date, which is defined over the relevant sub-group Ω_g but is based on fractional SES ranks $F_{\Omega_{CO}}(y_s)$ within the whole cohort not just the group itself.

To proceed we assume that $EI_{cs}^{CFL} = 8\mathrm{cov}(\Omega_{SU}, h_s, F_{\Omega_{SU}}(y_s))$ is the counterfactual level of health inequality that would have been observed at the start date in the absence of those who die by the end date, where this is simply taken to be the intra-group level of health inequality among the survivors based on fractional SES ranks $F_{\Omega_{SU}}(y_s)$ within the survivor group not the cohort as a whole. Hence the change in health inequality between the two dates may be written as:

$$EI_{cf} - EI_{cs} = \{EI_{cf} - EI_{cs}^{CFL}\} + \{EI_{cs}^{CFL} - EI_{cs}\} = M_c^{SU} + M_c^{NS} \quad (1)$$

where M_c^{NS} fully captures the direct effect of selective mortality on health inequality changes while M_c^{SU} captures the net effect of health and income rank changes among the surviving population.

M_c^{NS} can in turn be broken down into a set of component mobility indices that capture the three direct effects of selective mortality identified in the introduction. Following the approach taken in Allanson and Petrie (2013a), EI_{cs} may be exactly decomposed in the manner of Yitzhaki (1994) into a between-group component EI_{cs}^{BTW} and a weighted sum of within-group components, EI_{cs}^{SU} and EI_{cs}^{NS}:

$$EI_{cs} = EI_{cs}^{BTW} + p_c^{SU} EI_{cs}^{SU} + p_c^{NS} EI_{cs}^{NS} \quad (2)$$

$$= 8\mathrm{cov}(\Omega_{CO}, \bar{h}_s^g, \bar{F}_{\Omega_{CO}}^g(y_s)) + p_c^{SU} 8\mathrm{cov}(\Omega_{SU}, h_s, F_{\Omega_{CO}}(y_s)) + p_c^{NS} 8\mathrm{cov}(\Omega_{NS}, h_s, F_{\Omega_{CO}}(y_s))$$

where the weights p_c^{SU} and p_c^{NS} are the population proportions of the two groups in the cohort, $\bar{h}_s^g$ is the mean health of group g at the start date and $\bar{F}_{\Omega_{CO}}^g(y_s)$ is the corresponding mean fractional rank in the full cohort population. Hence M_c^{NS} is equal to:

$$M_c^{NS} = -EI_{cs}^{BTW} + p_c^{SU}[EI_{cs}^{NS} - EI_{cs}^{SU}] + [EI_{cs}^{CFL} - EI_{cs}^{NS}] \equiv M_c^{NSB} + M_c^{NSW} + M_c^{NSR} \quad (3)$$

where the derivation relies on the identity $p_c^{NS} = (1 - p_c^{SU})$.

First, the between-group mobility index $M_c^{NSB} = -EI_{cs}^{BTW}$ captures the effect of average differences in health and SES rank between survivors and non-survivors at the start of the interval. M_c^{NSB} is expected to be negative, as has previously been discussed, implying that health inequality at the end date is lower than otherwise would have been the case had the average health and/or SES rank of the two groups been the same initially. This equalising effect is likely to be increasingly large in older cohorts since $EI_{cs}^{BTW} = p_c^{NS}(1 - p_c^{NS})\left(\bar{h}_s^{SU} - \bar{h}_s^{NS}\right)\left(\bar{F}_{\Omega_{CO}}^{SU}(y_s)) - \bar{F}_{\Omega_{CO}}^{NS}(y_s))\right)$ is increasing in the mortality rate p_c^{NS} if $p_c^{NS} < 0.5$.

Second, the within-group difference mobility index $M_c^{NSW} = p_c^{NS}\left[EI_{cs}^{SU} - EI_{cs}^{NS}\right]$ captures the effect of any initial difference between the levels of health inequality within the survivor and non-survivor groups. M_c^{NSW} will equal zero if the social gradients in health of the two groups within the overall cohort population have the same slope. In general, whether M_c^{NSW} is positive or negative is an empirical question, which will depend both on the variation in health (and SES ranks) and on the strength of the correlation between health and SES in each of the two groups (cf. Milanovic, 1997). However, all other things equal, the size of the effect will be larger in older cohorts with higher mortality rates.

Third, the re-ranking index $M_c^{NSR} = \left[EI_{cs}^{CFL} - EI_{cs}^{NS}\right] = 8\mathrm{cov}\left(\Omega_{SU}, h_s, (F_{\Omega_{SU}}(y_s) - F_{\Omega_{CO}}(y_s))\right) = p_c^{NS}\, 8\, \mathrm{cov}\left(\Omega_s^{SU}, h_s, (\, F_{\Omega_{SU}}(y_s) - F_{\Omega_{NS}}(y_s))\right)$ captures the effect of any initial differences between the fractional ranks of survivors within the survivor and full cohort populations. M_c^{NSR} will equal zero if there are no rank differences, which would be the case if the risk of mortality was independent of SES, and generally seems to be negligible even in older cohorts with higher mortality rates.[3]

[3] See Allanson and Petrie (2013a) for further discussion of the properties of the re-ranking index, which it may be noted is not dependent on the health of non-survivors at the start date.

M_c^{SU} may also be further decomposed to offer a more detailed analysis of the effects of health and SES rank changes among the surviving population. For this purpose, we refine the decomposition procedure in Allanson et al. (2010) to provide a solution to the path dependency problem based on the symmetric treatment of SES and health changes:

$$
\begin{aligned}
M_c^{SU} = \; & M_c^{SUH} + M_c^{SUS} + M_c^{SUC} \qquad (3) \\
= \; & 8\mathrm{cov}\left(\Omega_{SU}, (h_f - h_s), F_{\Omega_{SU}}(y_s)\right) + 8\mathrm{cov}\left(\Omega_{SU}, h_s, \left(F_{\Omega_{SU}}(y_f) - F_{\Omega_{SU}}(y_s)\right)\right) \\
& + 8\mathrm{cov}\left(\Omega_{SU}, (h_f - h_s), \left(F_{\Omega_{SU}}(y_f) - F_{\Omega_{SU}}(y_s)\right)\right)
\end{aligned}
$$

where M_c^{SUH} is defined as the negative of the Allanson and Petrie (2013b) income-related health mobility index for the Erreygers index, while M_c^{SUS} and M_c^{SUC} sum to the corresponding health-related income mobility index.

M_c^{SUH}, M_c^{SUS} and M_c^{SUC} respectively capture the effects on health inequality of differences among survivors in health changes associated with initial socioeconomic status, SES changes related to initial health, and contemporaneous health and SES changes. For example, M_c^{SUC} will be positive if contemporaneous changes in health and SES are disequalising in absolute terms, which will the case if changes in health and SES rank over the interval are positively correlated with each other. The decomposition is potentially informative about the dynamic interdependence between health and SES to the extent that health and SES rank at the start date are predictive of health and SES rank changes over the interval. In particular, non-zero values of M_c^{SUH} and M_c^{SUS} may be indicative respectively of causal pathways from SES to health and vice versa, while non-zero values of M_c^{SUC} could be reflective of a bi-directional relationship and/or the existence of other factors that simultaneously influence both SES and health (cf. Cutler et al., 2008). But it must be borne in mind that all three mobility indices will be affected by the indirect effects of selective mortality. Petrie et al. (2011) have previously shown that explicitly taking death into account can change the direction of the association between relative health changes and initial SES rank from negative to positive.

2.2 Decomposition procedure based on end of interval counterfactual

For comparative purposes we also provide a decomposition based on the imputation of the 'would be' health of non-survivors at the end date. Let $h_f^* = (h_f^{SU}, \hat{h}_f^{NS})$ and $y_f^* = (y_f^{SU}, \hat{y}_f^{NS})$, where h_f^{SU} and y_f^{SU} are respectively the observed levels of health and SES of survivors at the end date, and $\hat{h}_f^{NS}$ and $\hat{y}_f^{NS}$ are the corresponding imputed levels for non-survivors. Hence $EI_{cf}^{CFL} = 8\text{cov}(\Omega_{CO}, h_f^*, F_{\Omega_{CO}}(y_f^*))$ is the counterfactual level of health inequality that would obtain at the end date if there had been no deaths during the time interval. The change in health inequality between the two dates may then be written as:

$$EI_{cf} - EI_{cs} = \{EI_{cf} - EI_{cf}^{CFL}\} + \{EI_{cf}^{CFL} - EI_{cs}\} = \widetilde{M}_c^{NS} + \widetilde{M}_c^{CO} \quad (4)$$

where $\widetilde{M}_c^{NS}$ provides an alternative measure of the direct effect of selective mortality on health inequality and $\widetilde{M}_c^{CO}$ captures the net effect of the partially imputed morbidity and SES rank changes in the full cohort population.

$\widetilde{M}_c^{NS}$ may be decomposed in the same way as M_c^{NS} to give:

$$\begin{aligned}
\widetilde{M}_c^{NS} &= \widetilde{M}_c^{NSB} + \widetilde{M}_c^{NSW} + \widetilde{M}_c^{NSR} \qquad (5)\\
&= -8\text{cov}\left(\Omega_{CO}, \bar{h}_f^{*g}, \bar{F}_{\Omega_{CO}}^{g}(y_f^*)\right)\\
&\quad + p_c^{NS}\left(8\text{cov}\left(\Omega_{SU}, h_f^{SU}, F_{\Omega_{CO}}(y_f^*)\right) - 8\text{cov}\left(\Omega_{NS}, \hat{h}_f^{NS}, F_{\Omega_{CO}}(y_f^*)\right)\right)\\
&\quad + 8\text{cov}\left(\Omega_{SU}, h_f^{SU}, F_{\Omega_{SU}}(y_f^*)\right) - 8\text{cov}\left(\Omega_{SU}, h_f^{SU}, F_{\Omega_{CO}}(y_f^*)\right)
\end{aligned}$$

where $\widetilde{M}_c^{NSB}$, $\widetilde{M}_c^{NSW}$ and $\widetilde{M}_c^{NSR}$ may be interpreted respectively as between-group, within-group difference and re-ranking mobility indices, as before, but will in general differ from M_c^{NSB}, M_c^{NSW} and M_c^{NSR} due to the path dependency of the decomposition procedure.

Moreover, the value of all three indices will depend upon the method chosen to impute the 'would be' health and SES of non-survivors.

Finally $\widetilde{M}_c^{CO}$ may also be decomposed to yield:

$$\widetilde{M}_c^{CO} = \widetilde{M}_c^{COH} + \widetilde{M}_c^{COS} + \widetilde{M}_c^{COC} \tag{6}$$

$$= 8\text{cov}\big(\Omega_{CO}, (h_f^* - h_s), F_{\Omega_{CO}}(y_s)\big) + 8\text{cov}\left(\Omega_{CO}, h_s, \big(F_{\Omega_{CO}}(y_f^*) - F_{\Omega_{CO}}(y_s)\big)\right)$$

$$+ 8\text{cov}\left(\Omega_{CO}, (h_f^* - h_s), \big(F_{\Omega_{CO}}(y_f^*) - F_{\Omega_{CO}}(y_s)\big)\right)$$

where the three indices respectively capture the effects on health inequality of differences among the full cohort in partially imputed health changes associated with initial SES rank, partially imputed SES rank changes related to initial health, and partially imputed contemporaneous health and SES rank changes.

3. Empirical analysis

We employ the decomposition procedures to uncover the changing nature of the inter-dependence between health and SES throughout adulthood using individual panel data for GB from the United Kingdom Household Longitudinal Study (UKHLS also known as 'Understanding Society'; University of Essex et al., 2017) and British Household Panel Survey (BHPS; University of Essex and Institute for Social and Economic Research, 2010).[4] Specifically, the main analysis uses UKHLS data to examine changes in health inequality in GB for rolling age groups over the period 2010-11 to 2015-2016, which is treated as a single time interval in order to ensure the occurrence of at least some deaths in all study cohorts. UKHLS is a nationally representative household panel survey that began collecting information in 2009-10 on over 60,000 enumerated persons in 30,000 responding private households, with the sample boosted from wave 2 (2010-11) by the inclusion of participants

[4] The analysis is limited to GB for comparative purposes because the BHPS data for Northern Ireland do not constitute a panel over the supplementary analysis period 1999 to 2004.

from the predecessor BHPS. Annual personal interviews are conducted with all adult household members and provide rich information on a wide range of topics including sociodemographic characteristics and self-assessed health (see Knies (ed.), 2017 for further details). We also undertake a number of supplementary analyses to explore the extent to which our main findings may be affected by key aspects of the study design, most notably the choice of SES variable, and may differ across the economic cycle.

3.1 Main analysis design

UKHLS records the cause of sample attrition between waves, including death, where this is known. For the main analysis, we use data from waves 2 and 7 to construct an unbalanced panel consisting of observations on the sub-set of individuals in the survey for whom full information on health, age, gender, educational attainment and income was available for both the start and end date of the study period or for whom full information was available for the start date and the individual was known to have died by the end date. Sample weights were used throughout the analysis with these being given by adjusted cross-sectional survey weights for the start date, where the adjustments were made using inverse probability weights (see Wooldridge, (2001)) to allow both for missing data for either the start or end date and for non-mortality related sample attrition over the study period (see Petrie et al. (2011) for further discussion). Bootstrap standard errors were obtained for all mean, inequality and mobility measures by the resampling of primary sampling units within each stratification class so as to reflect the survey sample design.

The cohort analysis is based on 15 year overlapping age groups (25-40,…,65-80, 70+) based on age in 2010-11, where the choice of age span was guided by the familiar trade-off between bias and variance. Longer age spans resulted in excessive smoothing of the age-stratified estimates as age groups start to encompass individuals facing very different mortality risks, particularly in later life. But age spans shorter than 15 years led to excessive variability in the estimates of the component mobility indices by age group, with the reduction in sample size becoming increasingly problematic in younger age groups in which the mortality rate is lower. Adults younger than 25 years old are excluded from the analysis since deaths in this age group were very uncommon.

3.2. Main analysis variable definitions

The health measure used in the study is Quality Adjusted Life Years (QALYs) derived from the responses to the SF-12v2 questionnaire in UKHLS using the SF-6D preference-based algorithm (Brazier et al, 2002). QALYs allow both the quality and quantity of health individuals experience to be combined into a single meaningful measure (see Drummond et al. (2015) for further discussion). The measure is bounded in the unit interval with full health corresponding to a value of one, the lowest possible health utility of anyone alive being equal to 0.345, and with death assigned a QALY of zero.

Educational attainment, defined as highest educational or vocational qualification, rather than income was chosen as the main measure of SES for a number of reasons. First educational attainment provides a more stable indicator of SES in adulthood. In particular, the transition from working life into retirement is associated with a significant fall in income (see e.g. Bardasi et al, 2002), with this leading to considerable movement within the income distributions of older age groups not least because of the range of ages over which people retire. Income is also more likely subject to reverse causation: poor health has been associated with both below-average income growth among working age adults (Deaton & Paxson, 1998) and above-average income growth among retirement age adults eligible for the receipt of additional disability and social care benefits (Zaidi, 2008). Second, income may be more prone to measurement error, with this a particular concern in older age groups (Zaidi, 2008). Finally, education has been found to provide a stronger predictor of the onset of chronic health conditions in adulthood than income or other financial measures (see e.g.

Smith, 2007). Educational attainment in the UKHLS is measured by the derived variable hiqual_dv that distinguishes between those with a degree, other higher degree, A level or equivalent, GCSE or equivalent, other qualifications, and none.

3.3 Supplementary analyses

A number of supplementary analyses were undertaken to explore the robustness of the main findings to key aspects of the study design. First we repeated the main analysis using income rather than educational attainment as the SES variable, where this might be expected to have at least some effect on the results for the reasons discussed above. Income is defined as net monthly household equivalent income and is equal to the total monthly income of all household members net of taxes and national insurance contributions and adjusted for household size and composition using the OECD-modified equivalence scale (i.e. income=fihhmnnet1_dv/ieqmoecd_dvbased). Separate subgroup analyses were also conducted for men and women. Finally we used BHPS data to generate results for GB for the five year time span 1999 to 2004, which was a period of strong economic growth and investment in public services in contrast to the austerity conditions prevailing throughout the main study period. Further details of the supplementary analyses are provided in Appendix 2.

4. Results

Table 1 presents descriptive statistics by rolling age group for health and educational attainment rank for the main analysis. Average cohort health in 2010-2011 was decreasing in age in early adulthood, stabilised in middle age and then dropped again more sharply in older cohorts. Similarly, the average health of survivors declined markedly in both early adulthood and old age over the five year time interval to 2015-16. In contrast, the mortality rate was strictly increasing with age, with 28.5% of the over-70 age group recorded as dead by 2015-

16. Non-survivors in all age groups had on average both worse health and lower SES rank than survivors in 2010-11, providing prima facie evidence of selective mortality.

Figure 1 shows that the within-cohort social gradient was generally increasing over the whole life course in both 2010-11 and 2015-16, consistent with a number of studies (e.g., Ross and Wu 1996; Mirowsky and Ross 2005) but contrary to the stylised fact that health inequalities tend to be lower in older cohorts. This might appear to rule out the possibility of significant selective mortality effects on health inequalities but such a conclusion would be unwarranted as the shape of the curves will in general reflect a combination of age, period and cohort effects. More revealing is a comparison of the location of the two curves, with health inequalities lower in 2015-16 than in 2010-11 in the 50-65 and all older age groups. Thus the pattern of individual health changes, educational attainment changes and deaths within each of these cohorts led to a fall in the social gradient among the surviving members of the cohort, although Table 2 shows that these changes were not generally statistically significant at conventional levels.

To further explore how the co-evolution of health and SES gave rise to the observed change in health inequality over the lifecycle, Table 2 presents results from our preferred decomposition procedure based on the start date counterfactual. The change in health inequality within each cohort $\left(EI_{cf} - EI_{cs}\right)$ is accounted for by the direct effect of selective mortality M_c^{NS} and the net effect of changes in morbidity and educational attainment among the surviving population M_c^{SU}, where both these terms are further broken down into three component mobility indices. In all cases a positive value indicates a contribution that results in higher health inequality among those still alive in 2015-16.

Looking first at the direct effects of selective mortality M_c^{NS} then the contribution to the overall change in health inequality is relatively small in early adulthood when mortality rates are very low, but becomes significantly negative and increasingly large in older cohorts.

The detailed decomposition show that the main driver of this effect was initial differences between the average health and SES rank of survivors and non-survivors M_c^{NSB}, with the disproportionate number of deaths among less educated and unhealthier individuals leading to significantly lower levels of final period health inequality in the 40-55 and older age groups. Estimates of the within-group difference and re-ranking mobility indices, M_c^{NSW} and M_c^{NSR}, are generally insignificant with the latter also being negligible in size.

The other half of the decomposition is less informative with none of the estimates of M_c^{SU} and very few of its component mobility indices significantly different from zero. The dominant component of M_c^{SU} in all age groups is SES-related health mobility M_c^{SUH}, which is to be expected given the relative stability of educational attainment in adulthood. The positive values of M_c^{SUH} in early adulthood imply that health losses among survivors were concentrated among the less educated and are therefore consistent with the cumulative advantage hypothesis. That this does not continue to be the case in older age groups may be due in part to the 'indirect' effects of selective mortality given that it is the less educated and less healthy in each cohort who are more likely to die. The other two components of M_c^{SU}, M_c^{SUS} and M_c^{SUC}, are both consistently smaller in magnitude and exhibit little obvious pattern across age groups.

4.1 Alternative results based on end date counterfactuals

The alternative decomposition procedure is based on the imputation of the end date health and educational attainment of non-survivors. Table 3 presents selected results obtained using three different imputation procedures, with full results provided in Appendix 1. The first procedure uses inverse probability weights to correct for selective attrition with the weights derived from a logit model in which the probability of survival to 2015-16 is specified as a function of age, sex, health, highest qualification, and the interaction of health and highest qualification in 2010-11. Thus, in the manner of Baeten et al. (2013), the imputed health and SES of non-survivors at the end of the study period is based on the observed health and SES outcomes of survivors who possessed similar characteristics to them at the start. As expected this procedure leads to smaller estimates of the direct effect of selective mortality than our preferred decomposition procedure, particularly in older age groups with lower survival rates, with exactly offsetting changes in the net effect of the partially imputed health and SES changes in the full cohort given that the decomposition must sum to the observed change in health inequality. The difference in the results between the two procedures is almost entirely due to the smaller size of the between-group mobility term, which is in turn largely attributable to the imputed health gaps between survivors and non-survivors in 2015-16 being smaller than the corresponding actual health gaps in 2010-11. That the IPW-imputed health gaps at the end date are likely biased downward due to the indirect effect of selective mortality may be inferred from Figure 2. This shows that in every age group the average imputed health of non-survivors in 2015-16 is higher than their average actual health in 2010-11, whereas the average health of survivors in all cohorts declined over the study period as reported in Table 1. We further note that the IPW estimates of the between-group effect for older cohorts are considerably smaller than in the second set of end date counterfactual results, which are based on the assumption that the health and highest qualification of non-survivors would have been the exactly the same in 2015-16 as in 2010-11 had they not died in the intervening period. This naïve 'no change' imputation procedure may plausibly be seen to provide an upper bound on the 'would-be' health of non-survivors with the resultant estimates of the direct effect of select mortality for the oldest cohorts still appreciably smaller than in our preferred approach. Finally, we present an estimate of SES-related health mobility based on the assignment of a QALY score of zero to non-survivors in 2015-16 but with no change in their educational attainment, which shows that health losses would indeed be concentrated among the less educated members of each cohort if deaths were explicitly taken into account in this way.

4.2 Results from supplementary analyses

The supplementary analyses are designed to explore the robustness of the main findings to key aspects of the study design other than the choice of start date counterfactual. Table 4 presents results with income rather than educational attainment as the SES variable, where this change might be expected to result in clearer evidence of direct selective mortality effects given that Figure 3 shows that health inequalities in both 2010-11 and 2015-16 were lower in each successively older cohort beyond the 45-60 age group. In practice the findings are more equivocal highlighting the previously identified weaknesses of income as a useful indicator of SES across the adult lifespan. It remains the case that the between groups effect M_c^{NSB} becomes significantly negative and increasingly large in middle and early old age groups but this effect is almost completely attenuated in the oldest 70+ cohort as the average income ranks of survivors and non-survivors in this age group were virtually identical to each other in 2010-11. Indeed the overall direct selective mortality index M_c^{NS} turns insignificantly positive in the two oldest age groups because of the contribution of M_c^{NSW} which reflects the positive difference in within-health inequality between the survivor and non-survivor groups in 2010-11 due to the lack of association between health and income rank among non-survivors. Moreover survivor mobility effects are relatively more important drivers of the overall change in health inequality due to the extent of income mobility in older age groups, with weak evidence of reverse causality provided by the health-related income mobility index M_c^{SUS} estimates.

Educational attainment is taken as the SES variable in all the other supplementary analyses. The decomposition results from these analyses are presented in Appendix 2 and very largely conform with those from the main analysis presented in Table 2. In particular the between groups effect $\mathrm{M}_{\mathrm{c}}^{\mathrm{NSB}}$ becomes significantly negative and increasingly large into late old age and thereby becomes the most important factor in explaining the observed change in the social gradient in health in later life.

5. Conclusion

This paper does not aim to present evidence on the causal nexus between SES and health over the life cycle, but rather to inform such analysis by fully accounting for the changing strength of the association between SES and health at different ages in terms of the contributions of selective mortality, morbidity changes and SES changes. In particular, the mobility indices presented in the paper should be interpreted as a sufficient set of summary statistics characterising the evolution of the joint distribution of health and SES over time rather than as structural parameters of some underlying dynamic process, providing 'catch-all' measures that encompass the variety of possible mechanisms as discussed, for instance, in Mirowsky & Ross (2008).

A particular attraction of our longitudinal decomposition methodology is the detailed account it provides of how selective mortality impacts on the evolution of health inequality over the life cycle. The results from our main empirical analysis reveal that selective mortality is an important driver of changes in cross-sectional health inequality over the lifecycle, especially in older age groups in which survival rates are lower, contrary to the findings in studies such as Beckett (2000) and Baeten et al. (2013). Specifically, initial differences between the average health and educational attainment rank of survivors and non-survivors are shown to be an increasingly important factor in explaining the observed change in the social gradient in health in later life. This contrast in findings is at least in part attributable to the utilisation of a counterfactual for the start rather than the end of the study period to identify the direct effects of selective mortality. Our approach, as a result, does not rely on the imputation of the ‘would be’ health and SES of non-survivors, which it is shown yields estimates of the between-group selective mortality effect that are biased towards zero if based on the health outcomes of survivors. We also clearly demonstrate that estimates of the direct effects of selective mortality are sensitive to the choice of SES measure, with educational attainment but not income rank a predictor of mortality risk in the oldest age group in our study.

Our preferred decomposition procedure further allows for the detailed analysis of the effects of health and SES changes conditional upon survival, with the symmetric treatment of health and SES rank changes having the potential to identify the nature of the interdependence of health and SES over the lifecycle. However, the results of this further analysis are relatively uninformative, likely reflecting the varying importance of a number of interacting mechanisms over the life course and with the use of income rather than educational attainment as the indicator of SES only serving to further complicate the picture. Nevertheless the proposed approach to identifying the drivers of the changing social gradient over the lifecycle represents a significant advance on those previously available in the literature, with estimation of the detailed selective mortality effects only requiring follow-up data on deaths even though full longitudinal data is required for the complete decomposition.

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Table 1. Descriptive statistics by rolling age groups for Great Britain

Age in 2010-11	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Mean Health 2010-11	0.791	0.785	0.780	0.774	0.771	0.771	0.772	0.769	0.752	0.708
Mortality rate	0.003	0.004	0.007	0.010	0.019	0.034	0.050	0.073	0.119	0.285
Mean SES rank 2010-11 (non-survivors)	0.418	0.392	0.433	0.392	0.410	0.373	0.418	0.402	0.422	0.421
Mean SES rank 2010-11 (survivors)	0.500	0.500	0.500	0.501	0.502	0.504	0.504	0.508	0.511	0.531
Mean Health 2010-11 (non-survivors)	0.702	0.634	0.649	0.651	0.686	0.684	0.677	0.672	0.662	0.637
Mean Health 2010-11 (survivors)	0.791	0.785	0.781	0.775	0.772	0.774	0.777	0.777	0.765	0.737
Mean Health 2016-17 (survivors only)	0.776	0.773	0.772	0.768	0.768	0.773	0.775	0.770	0.750	0.717

Source: Own calculation from UKHLS data.

Table 2. Start date counterfactual health inequality change decomposition: GB with SES=educational attainment, 2010-2011 to 2015-16.

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Initial inequality EI_{cs}	0.0322**	0.0387**	0.0398**	0.0451**	0.0494**	0.0587**	0.0558**	0.0630**	0.0576**	0.0714**
	0.0045	*0.0044*	*0.0042*	*0.0045*	*0.0048*	*0.0048*	*0.0048*	*0.0051*	*0.0062*	*0.0073*
Final inequality EI_{cf}	0.0354**	0.0411**	0.0409**	0.0439**	0.0508**	0.0511**	0.0475**	0.0475**	0.0513**	0.0601**
	0.0046	*0.0043*	*0.0043*	*0.0043*	*0.0045*	*0.0046*	*0.0048*	*0.0053*	*0.0066*	*0.0075*
Change in inequality $EI_{cf} - EI_{cs}$	0.0032	0.0024	0.0010	-0.0012	0.0014	-0.0076*	-0.0083*	-0.0155**	-0.0064	-0.0114
	0.0047	*0.0043*	*0.0041*	*0.0041*	*0.0041*	*0.0044*	*0.0044*	*0.0048*	*0.0061*	*0.0082*
Non-survivors mobility M_c^{NS}	0.0003	0.0000	-0.0005	-0.0018**	-0.0026**	-0.0049**	-0.0042**	-0.0067**	-0.0068**	-0.0127**
of which due to:	*0.0002*	*0.0005*	*0.0006*	*0.0007*	*0.0009*	*0.0013*	*0.0016*	*0.0020*	*0.0028*	*0.0054*
− Between-groups M_c^{NSB}	-0.0002	-0.0005	-0.0005	-0.0011**	-0.0012**	-0.0031**	-0.0032**	-0.0060**	-0.0076**	-0.0179**
	0.0002	*0.0003*	*0.0004*	*0.0005*	*0.0006*	*0.0008*	*0.0009*	*0.0013*	*0.0017*	*0.0030*
− Within-group difference M_c^{NSW}	0.0005**	0.0005	0.0000	-0.0008	-0.0015**	-0.0019*	-0.0010	-0.0008	0.0007	0.0047
	0.0002	*0.0003*	*0.0004*	*0.0005*	*0.0008*	*0.0011*	*0.0013*	*0.0015*	*0.0021*	*0.0045*
− Re-ranking M_c^{NSR}	0.0000	0.0000	0.0000	0.0000	0.0001*	0.0001	0.0000	0.0001	0.0001	0.0005
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0005*
Survivors mobility M_c^{SU}	0.0029	0.0025	0.0015	0.0006	0.0040	-0.0027	-0.0041	-0.0088*	0.0004	0.0013
of which due to:	*0.0048*	*0.0043*	*0.0041*	*0.0041*	*0.0041*	*0.0042*	*0.0043*	*0.0047*	*0.0055*	*0.0071*
− SES-related health changes M_c^{SUH}	0.0045	0.0039	0.0024	0.0023	0.0047	-0.0021	-0.0043	-0.0090*	0.0004	0.0013
	0.0049	*0.0042*	*0.0041*	*0.0041*	*0.0041*	*0.0042*	*0.0042*	*0.0047*	*0.0054*	*0.0070*
− Health-related SES changes M_c^{SUS}	-0.0029**	-0.0017	-0.0006	-0.0011	0.0001	-0.0009	-0.0002	-0.0005	0.0001	0.0006
	0.0014	*0.0011*	*0.0009*	*0.0009*	*0.0007*	*0.0006*	*0.0005*	*0.0004*	*0.0006*	*0.0008*
− Correlated health & SES changes M_c^{SUC}	0.0013	0.0003	-0.0002	-0.0005	-0.0008	0.0004	0.0004	0.0007*	-0.0001	-0.0005*
	0.0021	*0.0010*	*0.0009*	*0.0009*	*0.0007*	*0.0006*	*0.0005*	*0.0004*	*0.0004*	*0.0003*

*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.−*

Table 3. Selected decomposition results from alternative end date counterfactuals: GB with SES=educational attainment, 2010-11 to 2015-16.

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Change in inequality $EI_{cf} - EI_{cs}$	0.0032	0.0024	0.0010	-0.0012	0.0014	-0.0076 *	-0.0083 *	-0.0155 ***	-0.0064	-0.0114
	0.0047	*0.0043*	*0.0041*	*0.0041*	*0.0041*	*0.0044*	*0.0044*	*0.0048*	*0.0061*	*0.0082*
IPW imputation										
Full cohort mobility $\widetilde{M}_c^{CO}$	0.0030	0.0025	0.0016	0.0003	0.0034	-0.0049	-0.0061	-0.0117 **	-0.0021	-0.0023
of which due to:	*0.0048*	*0.0043*	*0.0041*	*0.0041*	*0.0041*	*0.0043*	*0.0043*	*0.0047*	*0.0057*	*0.0104*
− SES-related health changes $\widetilde{M}_c^{COH}$	0.0046	0.0039	0.0025	0.0019	0.0040	-0.0044	-0.0063	-0.0120 **	-0.0019	-0.0023
	0.0049	*0.0042*	*0.0041*	*0.0041*	*0.0041*	*0.0043*	*0.0043*	*0.0047*	*0.0057*	*0.0104*
Non-survivors mobility $\widetilde{M}_c^{NS}$	0.0001	0.0000	-0.0006	-0.0015 ***	-0.0020 ***	-0.0027 ***	-0.0022 ***	-0.0038 ***	-0.0042 **	-0.0090
of which due to:	*0.0001*	*0.0003*	*0.0005*	*0.0005*	*0.0006*	*0.0008*	*0.0008*	*0.0011*	*0.0020*	*0.0067*
− Between-groups $\widetilde{M}_c^{NSB}$	-0.0001	-0.0004 *	-0.0003	-0.0006 *	-0.0007 **	-0.0017 ***	-0.0019 ***	-0.0032 ***	-0.0040 ***	-0.0098 ***
	0.0001	*0.0002*	*0.0003*	*0.0003*	*0.0004*	*0.0005*	*0.0005*	*0.0007*	*0.0012*	*0.0031*
No change imputation										
Full cohort mobility $\widetilde{M}_c^{CO}$	0.0029	0.0025	0.0015	0.0006	0.0040	-0.0025	-0.0039	-0.0084 **	-0.0006	-0.0025
of which due to:	*0.0048*	*0.0043*	*0.0040*	*0.0040*	*0.0040*	*0.0041*	*0.0040*	*0.0043*	*0.0048*	*0.0050*
− SES-related health changes $\widetilde{M}_c^{COH}$	0.0045	0.0038	0.0023	0.0022	0.0046	-0.0021	-0.0042	-0.0087 **	-0.0007	-0.0027
	0.0049	*0.0042*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0043*	*0.0048*	*0.0050*
Non-survivors mobility $\widetilde{M}_c^{NS}$	0.0003	0.0000	-0.0005	-0.0019 **	-0.0026 ***	-0.0051 ***	-0.0044 ***	-0.0070 ***	-0.0058 **	-0.0089 *
of which due to:	*0.0002*	*0.0005*	*0.0006*	*0.0007*	*0.0009*	*0.0013*	*0.0016*	*0.0020*	*0.0027*	*0.0054*
− Between-groups $\widetilde{M}_c^{NSB}$	-0.0002	-0.0005 *	-0.0005	-0.0011 **	-0.0012 **	-0.0032 ***	-0.0033 ***	-0.0057 ***	-0.0067 ***	-0.0146 ***
	0.0002	*0.0003*	*0.0004*	*0.0005*	*0.0006*	*0.0008*	*0.0009*	*0.0012*	*0.0016*	*0.0027*
Imputation with $\hat{h}_f^{NS} = 0$ & $\hat{y}_f^{NS} = y_s^{NS}$										
− SES-related health changes $\widetilde{M}_c^{COH}$	0.0062	0.0063	0.0043	0.0066	0.0117 **	0.0180 ***	0.0143 **	0.0249 ***	0.0429 ***	0.0997 ***
	0.0050	*0.0044*	*0.0043*	*0.0046*	*0.0054*	*0.0063*	*0.0067*	*0.0082*	*0.0107*	*0.0153*

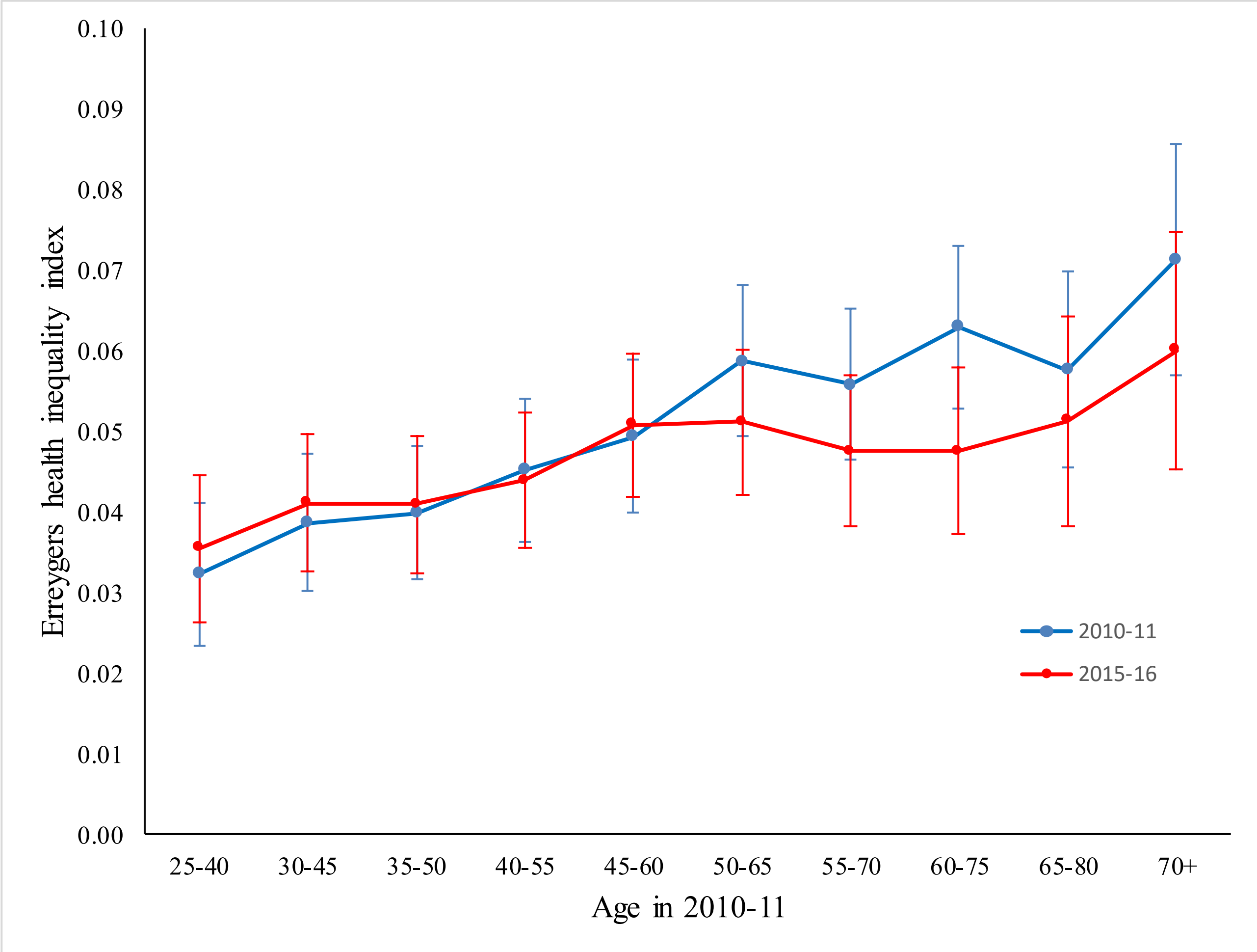
*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.−*

Table 4. Start date counterfactual health inequality change decomposition: GB with SES=income, 2010-2011 to 2015-16.

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Initial inequality EI_{cs}	0.0535***	0.0646***	0.0745***	0.0818***	0.0823***	0.0789***	0.0694***	0.0599***	0.0383***	0.0194**
	0.0047	*0.0045*	*0.0044*	*0.0043*	*0.0046*	*0.0048*	*0.0047*	*0.0049*	*0.0059*	*0.0082*
Final inequality EI_{cf}	0.0588***	0.0694***	0.0794***	0.0850***	0.0839***	0.0726***	0.0567***	0.0453***	0.0282***	0.0157*
	0.0053	*0.0049*	*0.0046*	*0.0045*	*0.0043*	*0.0045*	*0.0049*	*0.0055*	*0.0068*	*0.0094*
Change in inequality $EI_{cf} - EI_{cs}$	0.0053	0.0048	0.0049	0.0032	0.0017	-0.0063	-0.0127**	-0.0146**	-0.0101	-0.0038
	0.0059	*0.0052*	*0.0051*	*0.0049*	*0.0051*	*0.0054*	*0.0058*	*0.0058*	*0.0072*	*0.0104*
Non-survivors mobility M_c^{NS}	-0.0007	-0.0005	-0.0013**	-0.0019***	-0.0028***	-0.0042***	-0.0042***	-0.0032*	0.0026	0.0062
of which due to:	*0.0005*	*0.0005*	*0.0006*	*0.0006*	*0.0008*	*0.0010*	*0.0013*	*0.0017*	*0.0024*	*0.0057*
− Between-groups M_c^{NSB}	-0.0005	-0.0007*	-0.0010**	-0.0012**	-0.0016***	-0.0027***	-0.0034***	-0.0039***	-0.0040***	-0.0012
	0.0004	*0.0004*	*0.0005*	*0.0005*	*0.0006*	*0.0007*	*0.0009*	*0.0011*	*0.0014*	*0.0028*
− Within-group difference M_c^{NSW}	-0.0002	0.0002	-0.0003	-0.0006	-0.0011	-0.0012	-0.0005	0.0011	0.0064***	0.0072
	0.0003	*0.0003*	*0.0005*	*0.0005*	*0.0007*	*0.0009*	*0.0012*	*0.0015*	*0.0021*	*0.0050*
− Re-ranking M_c^{NSR}	0.0000	0.0000	0.0000	-0.0001	-0.0001	-0.0003***	-0.0003***	-0.0003*	0.0001	0.0002
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0002*	*0.0003*
Survivors mobility M_c^{SU}	0.0060	0.0054	0.0062	0.0051	0.0045	-0.0021	-0.0085	-0.0114*	-0.0126*	-0.0099
of which due to:	*0.0059*	*0.0053*	*0.0051*	*0.0049*	*0.0050*	*0.0054*	*0.0057*	*0.0059*	*0.0072*	*0.0100*
− SES-related health changes M_c^{SUH}	-0.0009	0.0004	0.0013	0.0011	0.0021	-0.0027	-0.0047	-0.0047	0.0034	0.0008
	0.0052	*0.0043*	*0.0043*	*0.0039*	*0.0043*	*0.0042*	*0.0045*	*0.0044*	*0.0056*	*0.0083*
− Health-related SES changes M_c^{SUS}	-0.0010	-0.0008	0.0001	0.0012	0.0018	0.0000	-0.0055	-0.0067	-0.0156***	-0.0126
	0.0039	*0.0037*	*0.0034*	*0.0038*	*0.0039*	*0.0042*	*0.0043*	*0.0044*	*0.0053*	*0.0077*
− Correlated health & SES changes M_c^{SUC}	0.0078*	0.0057*	0.0047	0.0028	0.0005	0.0006	0.0016	0.0001	-0.0005	0.0019
	0.0043	*0.0034*	*0.0035*	*0.0033*	*0.0037*	*0.0039*	*0.0041*	*0.0038*	*0.0046*	*0.0065*

*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.*

Figure 1: Within-cohort educational qualification gradient in health by age group and year



Note: Error bars delimit bounds of 95% confidence interval.

Figure 2: Average health changes by age group: actual for survivors and IPW-imputed for non-survivors

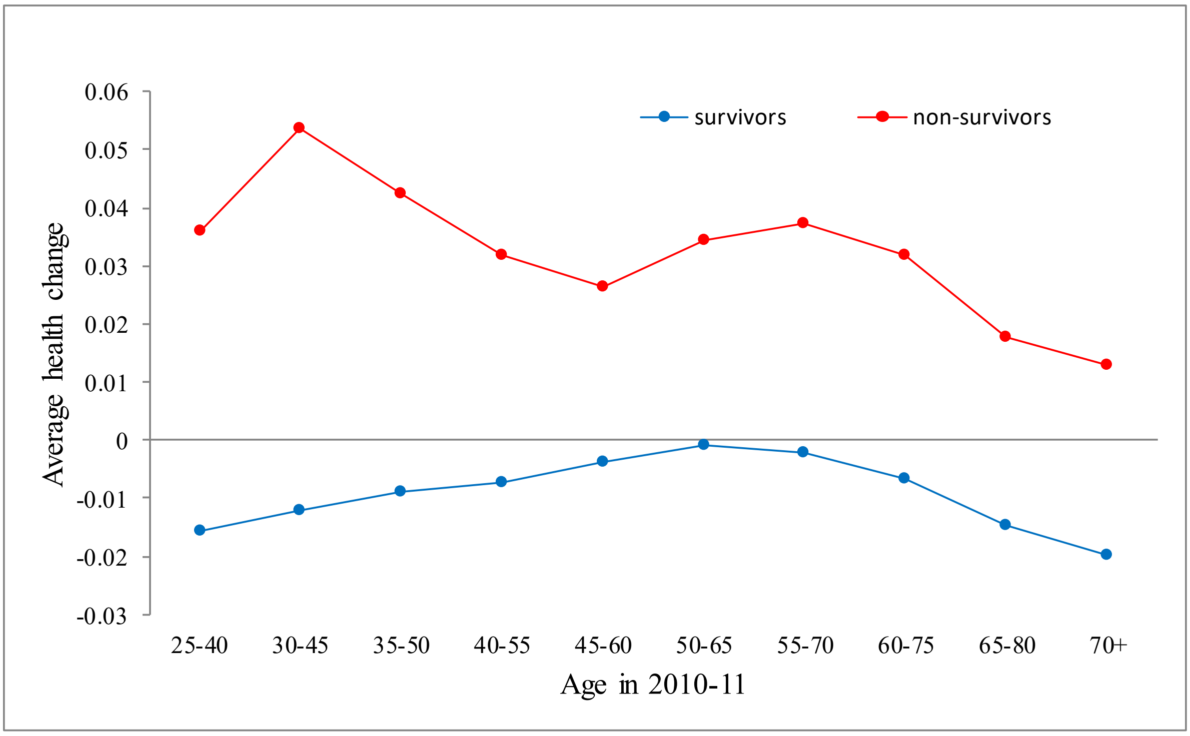
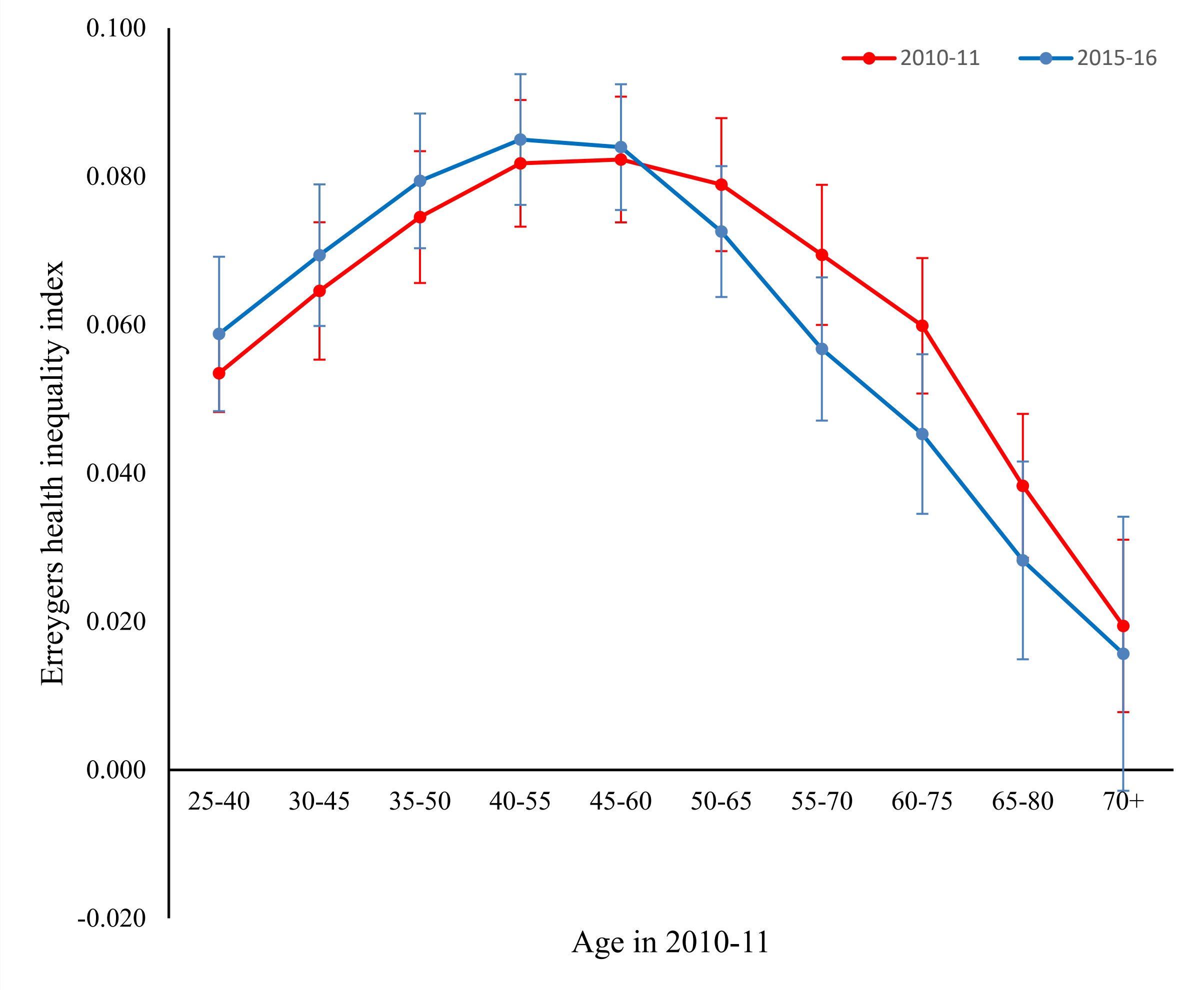


Figure 3: Within-cohort income gradient in health by age group and year



Note: Error bars delimit bounds of 95% confidence interval.

Appendix 1: Full decomposition results based on alternative final period counterfactuals

Tables A1.1–A1.3 all give decomposition results based on a final date counterfactual for GB over the study period 2010-11 to 2015-16 with educational attainment as the SES variable, but based on different procedures to impute the health and educational attainment of non-survivors in 2015-16:

(i) Table A1.1 is based on the IPW imputation procedure described in the main text.

(ii) Table A1.2 is based on the assumption of no change from 2010-11, i.e. $\hat{h}_f^{NS} = h_s^{NS}$ and $\hat{y}_f^{NS} = y_s^{NS}$.

(iii) Table A1.3 is based on the assignment of a QALY score of zero and no change in education attainment from 2010-11, i.e. $\hat{h}_f^{NS} = 0$ and $\hat{y}_f^{NS} = y_s^{NS}$

Table A1.1. End date counterfactual decomposition with IPW imputation: GB with SES=educational attainment, 2010-2011 to 2015-16

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Change in inequality $EI_{cf} - EI_{cs}$	0.0032	0.0024	0.0010	-0.0012	0.0014	-0.0076*	-0.0083*	-0.0155***	-0.0064	-0.0114
	0.0047	*0.0043*	*0.0041*	*0.0041*	*0.0041*	*0.0044*	*0.0044*	*0.0048*	*0.0061*	*0.0082*
Full cohort mobility $\widetilde{M}_c^{CO}$	0.0030	0.0025	0.0016	0.0003	0.0034	-0.0049	-0.0061	-0.0117**	-0.0021	-0.0023
of which due to:	*0.0048*	*0.0043*	*0.0041*	*0.0041*	*0.0041*	*0.0043*	*0.0043*	*0.0047*	*0.0057*	*0.0104*
− SES-related health changes $\widetilde{M}_c^{COH}$	0.0046	0.0039	0.0025	0.0019	0.0040	-0.0044	-0.0063	-0.0120**	-0.0019	-0.0023
	0.0049	*0.0042*	*0.0041*	*0.0041*	*0.0041*	*0.0043*	*0.0043*	*0.0047*	*0.0057*	*0.0104*
− Health-related SES changes $\widetilde{M}_c^{COS}$	-0.0028**	-0.0016	-0.0003	-0.0011	0.0001	-0.0015*	-0.0007	-0.0015	-0.0023	-0.0032
	0.0014	0.0011	0.0009	0.0009	0.0008	0.0009	0.0009	0.0012	0.0026	0.0070
− Correlated health & SES changes $\widetilde{M}_c^{COC}$	0.0013	0.0002	-0.0005	-0.0006	-0.0008	0.0010	0.0009	0.0018	0.0020	0.0032
	0.0021	0.0010	0.0010	0.0010	0.0009	0.0009	0.0009	0.0011	0.0026	0.0069
Non-survivors mobility $\widetilde{M}_c^{NS}$	0.0001	0.0000	-0.0006	-0.0015***	-0.0020***	-0.0027***	-0.0022***	-0.0038***	-0.0042**	-0.0090
of which due to:	*0.0001*	*0.0003*	*0.0005*	*0.0005*	*0.0006*	*0.0008*	*0.0008*	*0.0011*	*0.0020*	*0.0067*
− Between-groups $\widetilde{M}_c^{NSB}$	-0.0001	-0.0004*	-0.0003	-0.0006*	-0.0007**	-0.0017***	-0.0019***	-0.0032***	-0.0040***	-0.0098***
	0.0001	*0.0002*	*0.0003*	*0.0003*	*0.0004*	*0.0005*	*0.0005*	*0.0007*	*0.0012*	*0.0031*
− Within-group difference $\widetilde{M}_c^{NSW}$	0.0002**	0.0003	-0.0003	-0.0009**	-0.0013***	-0.0011*	-0.0003	-0.0005	-0.0004	0.0003
	0.0001	*0.0002*	*0.0003*	*0.0004*	*0.0005*	*0.0006*	*0.0007*	*0.0009*	*0.0015*	*0.0050*
− Re-ranking $\widetilde{M}_c^{NSR}$	0.0000	0.0000	0.0000	0.0000	0.0001**	0.0001	0.0001	0.0000	0.0002	0.0005
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0005*

*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.*

Table A1.2. End date counterfactual decomposition with $\hat{h}_f^{NS} = h_s^{NS}$ and $\hat{y}_f^{NS} = y_s^{NS}$: GB with SES=educational attainment, 2010-2011 to 2015-16

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Change in inequality $EI_{cf} - EI_{cs}$	0.0032	0.0024	0.0010	-0.0012	0.0014	-0.0076*	-0.0083*	-0.0155**	-0.0064	-0.0114
	0.0047	*0.0043*	*0.0041*	*0.0041*	*0.0041*	*0.0044*	*0.0044*	*0.0048*	*0.0061*	*0.0082*
Full cohort mobility $\widetilde{M}_c^{CO}$	0.0029	0.0025	0.0015	0.0006	0.0040	-0.0025	-0.0039	-0.0084**	-0.0006	-0.0025
of which due to:	*0.0048*	*0.0043*	*0.0040*	*0.0040*	*0.0040*	*0.0041*	*0.0040*	*0.0043*	*0.0048*	*0.0050*
− SES-related health changes $\widetilde{M}_c^{COH}$	0.0045	0.0038	0.0023	0.0022	0.0046	-0.0021	-0.0042	-0.0087**	-0.0007	-0.0027
	0.0049	*0.0042*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0043*	*0.0048*	*0.0050*
− Health-related SES changes $\widetilde{M}_c^{COS}$	-0.0028*	-0.0017	-0.0006	-0.0010	0.0002	-0.0008	-0.0001	-0.0003	0.0002	0.0007
	0.0014	0.0011	0.0009	0.0009	0.0007	0.0006	0.0005	0.0004	0.0006	0.0006
− Correlated health & SES changes $\widetilde{M}_c^{COC}$	0.0012	0.0003	-0.0002	-0.0005	-0.0008	0.0004	0.0004	0.0007*	-0.0001	-0.0004*
	0.0020	0.0010	0.0009	0.0009	0.0007	0.0006	0.0005	0.0004	0.0003	0.0002
Non-survivors mobility $\widetilde{M}_c^{NS}$	0.0003	0.0000	-0.0005	-0.0019*	-0.0026**	-0.0051**	-0.0044**	-0.0070**	-0.0058**	-0.0089*
of which due to:	*0.0002*	*0.0005*	*0.0006*	*0.0007*	*0.0009*	*0.0013*	*0.0016*	*0.0020*	*0.0027*	*0.0054*
− Between-groups $\widetilde{M}_c^{NSB}$	-0.0002	-0.0005*	-0.0005	-0.0011*	-0.0012**	-0.0032**	-0.0033**	-0.0057**	-0.0067**	-0.0146**
	0.0002	*0.0003*	*0.0004*	*0.0005*	*0.0006*	*0.0008*	*0.0009*	*0.0012*	*0.0016*	*0.0027*
− Within-group difference $\widetilde{M}_c^{NSW}$	0.0005*	0.0005*	0.0000	-0.0008	-0.0014*	-0.0020*	-0.0012	-0.0014	0.0008	0.0051
	0.0002	*0.0003*	*0.0004*	*0.0005*	*0.0008*	*0.0011*	*0.0013*	*0.0015*	*0.0022*	*0.0045*
− Re-ranking $\widetilde{M}_c^{NSR}$	0.0000	0.0000	0.0000	0.0000	0.0001**	0.0001	0.0001	0.0001	0.0001	0.0006
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0005*

*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.*

Table A1.3. End date counterfactual decomposition with $\hat{h}_f^{NS} = 0$ and $\hat{y}_f^{NS} = y_s^{NS}$: GB with SES=educational attainment, 2010-2011 to 2015-16

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Change in inequality $EI_{cf} - EI_{cs}$	0.0032	0.0024	0.0010	-0.0012	0.0014	-0.0076*	-0.0083*	-0.0155**	-0.0064	-0.0114
	0.0047	*0.0043*	*0.0041*	*0.0041*	*0.0041*	*0.0044*	*0.0044*	*0.0048*	*0.0061*	*0.0082*
Full cohort mobility $\widetilde{M}_c^{CO}$	0.0050	0.0052	0.0039	0.0055	0.0119**	0.0186**	0.0155**	0.0259**	0.0439**	0.1015**
of which due to:	*0.0049*	*0.0045*	*0.0044*	*0.0046*	*0.0054*	*0.0064*	*0.0068*	*0.0082*	*0.0108*	*0.0153*
− SES-related health changes $\widetilde{M}_c^{COH}$	0.0062	0.0063	0.0043	0.0066	0.0117**	0.0180**	0.0143**	0.0249**	0.0429**	0.0997**
	0.0050	*0.0044*	*0.0043*	*0.0046*	*0.0054*	*0.0063*	*0.0067*	*0.0082*	*0.0107*	*0.0153*
− Health-related SES changes $\widetilde{M}_c^{COS}$	-0.0028*	-0.0017	-0.0006	-0.0010	0.0002	-0.0008	-0.0001	-0.0003	0.0002	0.0007
	0.0014	0.0011	0.0009	0.0009	0.0007	0.0006	0.0005	0.0004	0.0006	0.0006
− Correlated health & SES changes							**	**		
$\widetilde{M}_c^{COC}$	0.0016	0.0006	0.0002	0.0000	0.0000	0.0014**	0.0013*	0.0013*	0.0007*	0.0011**
	0.0021	0.0010	0.0009	0.0009	0.0007	0.0006	0.0005	0.0005	0.0004	0.0005
Non-survivors mobility $\widetilde{M}_c^{NS}$	-0.0018	-0.0028*	-0.0029	-0.0068**	-0.0105**	-0.0262**	-0.0238**	-0.0413**	-0.0503**	-0.1128**
of which due to:	*0.0011*	*0.0016*	*0.0020*	*0.0026*	*0.0038*	*0.0052*	*0.0060*	*0.0076*	*0.0109*	*0.0167*
− Between-groups $\widetilde{M}_c^{NSB}$	-0.0019*	-0.0030*	-0.0032	-0.0073**	-0.0116**	-0.0280**	-0.0262**	-0.0448**	-0.0565**	-0.1304**
	0.0011	*0.0016*	*0.0020*	*0.0027*	*0.0038*	*0.0053*	*0.0060*	*0.0077*	*0.0111*	*0.0168*
− Within-group difference $\widetilde{M}_c^{NSW}$	0.0001**	0.0002**	0.0003**	0.0004**	0.0010**	0.0017**	0.0024**	0.0035**	0.0061**	0.0169**
	0.0000	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0003*	*0.0004*	*0.0008*	*0.0022*
− Re-ranking $\widetilde{M}_c^{NSR}$	0.0000	0.0000	0.0000	0.0000	0.0001**	0.0001	0.0001	0.0001	0.0001	0.0006
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0005*

*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.*

Appendix 2: Additional supplementary analyses

Table A2.1a gives results based on the start date counterfactual for GB over the study period 2010-11 to 2015-16 with educational attainment as the SES variable, but for women only.

Table A2.1b gives results based on the start date counterfactual for GB over the study period 2010-11 to 2015-16 with educational attainment as the SES variable, but for men only.

Table A2.2 gives results based on the start date counterfactual for GB with educational attainment as the SES variable, but over the study period 1999 to 2004 rather than 2010-11 to 2015-16. The analysis employs data from British Household Panel Survey waves 9 and 14. Health in QALYs is calculated from the responses to the SF-36 questionnaire using the SF-6D preference-based algorithm (Brazier et al, 2002). Education is measured by the BHPS variable QFEDHI with the number of categories collapsed from 13 to 6 to correspond as closely as possible to the coding of the highest qualification variable in the main analysis.

Table A2.1a. Start date counterfactual decomposition: GB women only with SES=educational attainment, 2010-2011 to 2015-16

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Initial inequality EI_{cs}	0.0456***	0.0501***	0.0467***	0.0493***	0.0518***	0.0517***	0.0519***	0.0491***	0.0479***	0.0504***
	0.0061	*0.0057*	*0.0060*	*0.0061*	*0.0065*	*0.0063*	*0.0065*	*0.0071*	*0.0080*	*0.0098*
Final inequality EI_{cf}	0.0511***	0.0518***	0.0530***	0.0529***	0.0555***	0.0471***	0.0470***	0.0428***	0.0433***	0.0504***
	0.0063	*0.0057*	*0.0058*	*0.0062*	*0.0063*	*0.0064*	*0.0067*	*0.0071*	*0.0084*	*0.0110*
Change in inequality $EI_{cf} - EI_{cs}$	0.0055	0.0017	0.0064	0.0036	0.0036	-0.0046	-0.0049	-0.0064	-0.0046	0.0000
	0.0064	*0.0057*	*0.0052*	*0.0055*	*0.0051*	*0.0057*	*0.0058*	*0.0065*	*0.0077*	*0.0103*
Non-survivors mobility M_c^{NS}	0.0000	-0.0009	-0.0007	-0.0016*	-0.0012	-0.0050***	-0.0044**	-0.0066***	-0.0088***	-0.0057
of which due to:	*0.0002*	*0.0007*	*0.0007*	*0.0009*	*0.0010*	*0.0015*	*0.0018*	*0.0022*	*0.0032*	*0.0065*
− Between-groups M_c^{NSB}	-0.0002	-0.0010	-0.0009*	-0.0012*	-0.0004	-0.0017*	-0.0023**	-0.0051***	-0.0085***	-0.0160***
	0.0002	*0.0007*	*0.0006*	*0.0007*	*0.0004*	*0.0010*	*0.0011*	*0.0015*	*0.0022*	*0.0035*
− Within-group difference M_c^{NSW}	0.0002*	0.0002	0.0002	-0.0005	-0.0008	-0.0034***	-0.0022	-0.0016	-0.0002	0.0105**
	0.0001	*0.0003*	*0.0004*	*0.0005*	*0.0009*	*0.0011*	*0.0015*	*0.0016*	*0.0022*	*0.0053*
− Re-ranking M_c^{NSR}	0.0000*	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	-0.0003
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0005*
Survivors mobility M_c^{SU}	0.0056	0.0026	0.0071	0.0052	0.0048	0.0004	-0.0005	0.0003	0.0042	0.0057
of which due to:	*0.0064*	*0.0056*	*0.0052*	*0.0055*	*0.0051*	*0.0054*	*0.0056*	*0.0061*	*0.0072*	*0.0090*
− SES-related health changes M_c^{SUH}	0.0062	0.0029	0.0074	0.0054	0.0043	-0.0003	-0.0011	0.0000	0.0033	0.0041
	0.0064	*0.0056*	*0.0051*	*0.0054*	*0.0051*	*0.0054*	*0.0055*	*0.0061*	*0.0071*	*0.0090*
− Health-related SES changes M_c^{SUS}	-0.0022	-0.0023*	-0.0016	-0.0020	0.0008	0.0001	0.0006	-0.0001	0.0009	0.0020*
	0.0017	0.0013	0.0013	0.0013	0.0009	0.0006	0.0005	0.0004	0.0007	0.0011
− Correlated health & SES changes M_c^{SUC}	0.0016	0.0019	0.0012	0.0017	-0.0004	0.0006	0.0000	0.0004	0.0000	-0.0003
	0.0021	0.0013	0.0012	0.0012	0.0010	0.0007	0.0004	0.0003	0.0003	0.0003

*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.*

Table A2.1b. Start date counterfactual decomposition: GB men only with SES=educational attainment, 2010-2011 to 2015-16

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Initial inequality EI_{cs}	0.0161**	0.0234***	0.0302***	0.0397***	0.0449***	0.0629***	0.0553***	0.0718***	0.0615***	0.0807***
	0.0071	*0.0065*	*0.0064*	*0.0070*	*0.0070*	*0.0071*	*0.0070*	*0.0076*	*0.0094*	*0.0106*
Final inequality EI_{cf}	0.0163**	0.0268***	0.0250***	0.0333***	0.0429***	0.0502***	0.0397***	0.0443***	0.0499***	0.0566***
	0.0069	*0.0067*	*0.0066*	*0.0068*	*0.0067*	*0.0068*	*0.0065*	*0.0076*	*0.0091*	*0.0119*
Change in inequality $EI_{cf} - EI_{cs}$	0.0002	0.0034	-0.0052	-0.0064	-0.0020	-0.0126*	-0.0156**	-0.0276***	-0.0116	-0.0240*
	0.0079	*0.0068*	*0.0062*	*0.0058*	*0.0062*	*0.0070*	*0.0066*	*0.0071*	*0.0085*	*0.0133*
Non-survivors mobility M_c^{NS}	0.0005	0.0010	-0.0002	-0.0020	-0.0046***	-0.0056**	-0.0052**	-0.0083**	-0.0061	-0.0218**
of which due to:	*0.0005*	*0.0006*	*0.0010*	*0.0013*	*0.0018*	*0.0022*	*0.0026*	*0.0036*	*0.0047*	*0.0085*
− Between-groups M_c^{NSB}	-0.0001	-0.0002	0.0000	-0.0005	-0.0023*	-0.0053***	-0.0054***	-0.0089***	-0.0098***	-0.0215***
	0.0002	*0.0004*	*0.0006*	*0.0008*	*0.0012*	*0.0016*	*0.0016*	*0.0023*	*0.0027*	*0.0049*
− Within-group difference M_c^{NSW}	0.0007*	0.0012**	-0.0002	-0.0015*	-0.0024*	-0.0004	0.0001	0.0004	0.0035	-0.0019
	0.0004	*0.0006*	*0.0008*	*0.0009*	*0.0013*	*0.0017*	*0.0019*	*0.0025*	*0.0036*	*0.0066*
− Re-ranking M_c^{NSR}	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0002	0.0002	0.0016*
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0003*	*0.0009*
Survivors mobility M_c^{SU}	-0.0003	0.0024	-0.0050	-0.0044	0.0026	-0.0070	-0.0104	-0.0193***	-0.0054	-0.0023
of which due to:	*0.0079*	*0.0068*	*0.0062*	*0.0057*	*0.0061*	*0.0067*	*0.0064*	*0.0065*	*0.0080*	*0.0117*
− SES-related health changes M_c^{SUH}	0.0024	0.0049	-0.0041	-0.0015	0.0044	-0.0050	-0.0101	-0.0194***	-0.0046	-0.0007
	0.0080	*0.0068*	*0.0062*	*0.0058*	*0.0060*	*0.0067*	*0.0064*	*0.0065*	*0.0080*	*0.0115*
− Health-related SES changes M_c^{SUS}	-0.0035	-0.0008	0.0010	0.0003	-0.0005	-0.0021*	-0.0013	-0.0010	-0.0006	-0.0008
	0.0025	0.0016	0.0013	0.0014	0.0011	0.0011	0.0010	0.0009	0.0010	0.0011
− Correlated health & SES changes M_c^{SUC}	0.0007	-0.0017	-0.0019	-0.0031**	-0.0013	0.0001	0.0010	0.0010	-0.0002	-0.0008
	0.0039	0.0017	0.0014	0.0015	0.0011	0.0010	0.0009	0.0008	0.0007	0.0005

*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.*

Table A2.2. Start date counterfactual decomposition: GB with SES=educational attainment, 1999 to 2004

	Age in 2010-11									
	25-40	30-45	35-50	40-55	45-60	50-65	55-70	60-75	65-80	70+
Initial inequality EI_{cs}	0.0207***	0.0268***	0.0296***	0.0319***	0.0404***	0.0454***	0.0479***	0.0418***	0.0447***	0.0461***
	0.0056	*0.0058*	*0.0063*	*0.0066*	*0.0075*	*0.0079*	*0.0090*	*0.0083*	*0.0093*	*0.0093*
Final inequality EI_{cf}	0.0270***	0.0232***	0.0309***	0.0316***	0.0442***	0.0457***	0.0541***	0.0518***	0.0412***	0.0215**
	0.0065	*0.0063*	*0.0062*	*0.0067*	*0.0075*	*0.0073*	*0.0085*	*0.0089*	*0.0102*	*0.0108*
Change in inequality $EI_{cf} - EI_{cs}$	0.0063	-0.0036	0.0012	-0.0003	0.0038	0.0003	0.0062	0.0100	-0.0035	-0.0246**
	0.0056	*0.0068*	*0.0062*	*0.0067*	*0.0070*	*0.0074*	*0.0082*	*0.0090*	*0.0100*	*0.0112*
Non-survivors mobility M_c^{NS}	0.0002	-0.0001	0.0001	-0.0004	-0.0040	-0.0049*	-0.0050	-0.0057	-0.0125**	-0.0197***
of which due to:	*0.0002*	*0.0002*	*0.0005*	*0.0011*	*0.0025*	*0.0029*	*0.0034*	*0.0038*	*0.0049*	*0.0063*
− Between-groups M_c^{NSB}	0.0000	0.0000	-0.0001	-0.0006	-0.0020	-0.0038**	-0.0054**	-0.0063***	-0.0087***	-0.0122***
	0.0001	*0.0001*	*0.0002*	*0.0006*	*0.0015*	*0.0019*	*0.0022*	*0.0023*	*0.0030*	*0.0031*
− Within-group difference M_c^{NSW}	0.0002	-0.0001	0.0002	0.0002	-0.0021	-0.0013	0.0002	0.0002	-0.0042	-0.0078
	0.0002	*0.0002*	*0.0005*	*0.0009*	*0.0016*	*0.0020*	*0.0024*	*0.0032*	*0.0044*	*0.0060*
− Re-ranking M_c^{NSR}	0.0000	0.0000	0.0000	0.0000	0.0001*	0.0002*	0.0002	0.0003*	0.0003	0.0002
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0003*	*0.0004*
Survivors mobility M_c^{SU}	0.0061	-0.0035	0.0012	0.0000	0.0078	0.0052	0.0112	0.0157*	0.0090	-0.0049
of which due to:	*0.0057*	*0.0068*	*0.0063*	*0.0066*	*0.0065*	*0.0069*	*0.0077*	*0.0084*	*0.0093*	*0.0098*
− SES-related health changes M_c^{SUH}	0.0069	0.0009	0.0045	0.0002	0.0031	-0.0014	0.0075	0.0114	0.0074	-0.0064
	0.0057	*0.0069*	*0.0066*	*0.0063*	*0.0063*	*0.0065*	*0.0077*	*0.0082*	*0.0093*	*0.0098*
− Health-related SES changes M_c^{SUS}	0.0016	-0.0026	-0.0025	-0.0004	0.0037	0.0055**	0.0018	0.0011	-0.0002	-0.0004
	0.0022	0.0025	0.0029	0.0031	0.0024	0.0027	0.0019	0.0019	0.0006	0.0005
− Correlated health & SES changes M_c^{SUC}	-0.0024	-0.0018	-0.0008	0.0003	0.0010	0.0011	0.0018	0.0032*	0.0019*	0.0020*
	0.0026	0.0030	0.0031	0.0028	0.0023	0.0022	0.0017	0.0018	0.0010	0.0011

*Cluster-robust standard errors in italics. *** significant at the 1% level, ** significant at the 5% level, *significant at 10% level.*